

NASA - SATS

Small Aircraft Transportation System

An aerial photograph of an airport with a city skyline in the background. A large white propeller plane is in the foreground, and a yellow helicopter is in the middle ground. The airport has a long runway and several smaller aircraft parked on the tarmac.

Transportation Research Board Annual Convention
Washington, DC
January 13, 2001

Dr. Bruce J. Holmes
Manager, General Aviation Programs Office
NASA Langley Research Center

An aerial illustration of a futuristic transportation hub. A long, straight runway or track runs diagonally across the frame. To the left, a city skyline is visible in the distance. To the right, a yellow helicopter is in flight. In the foreground, a white, sleek, high-speed train or aircraft is moving along a curved track. The scene is set in a green, hilly landscape with a body of water in the background.

Office of Aerospace Technology

Goal - Revolutionize Aviation

Mobility Objective (Stretch)

Reduce door-to-door travel time by half in ten years and two-thirds in 25 year. Reduce transcontinental travel time by half within 25 years.



Outline

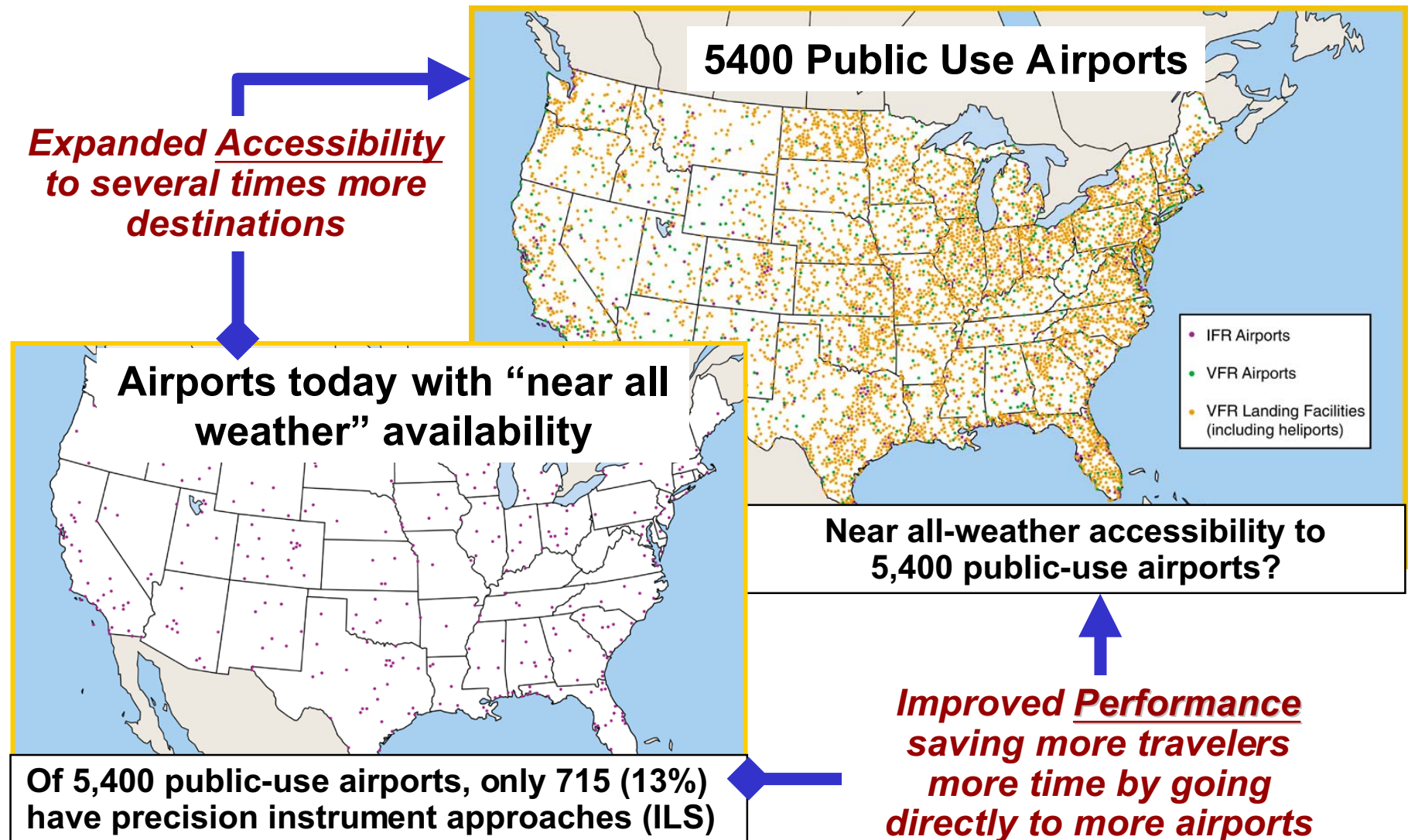


- **NASA Aerospace Enterprise**
 - **Revolutionize Aviation Goal**
 - **Mobility Metric**
 - **SATS Program Metrics**
- **SATS Operating Capabilities**
- **Topics for Breakout Group Dialogue**



Underutilized Airports and Airspace ...

... an Opportunity for Increasing Mobility



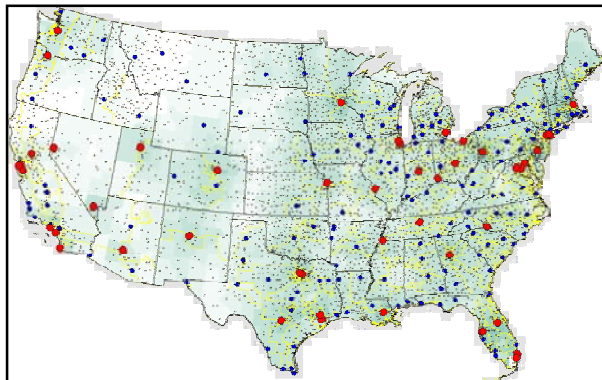


Mobility Parameters

NASA Aerospace Enterprise

Revolutionize Aviation Goal

Mobility Objectives



Mobility

*Enable people to travel
faster and farther,
anywhere, anytime*

- 93% of population within 30 minutes of SATS-type airport
- 41% within 30 minutes of any commercial airport
- 22% within 30 minutes of major/hub airport

Performance

*Less travel time
at an affordable price*

Accessibility

*Safe reliable access to
more locations, when &
where you need it*

Cost

*User cost
System cost
Provider cost*

Time

*Doorstep to
destination, with
intermodal penalties*

Availability

*Convenient,
on-demand, with
mission reliability*

Safety

*Proven safer
Perceived safer*



SATS Products Create Mobility



Premise: Affordable Access to More Local Airports = Increased Mobility

**5 Year
Goal**

Demonstrate key airborne technologies for precise guided accessibility in small aircraft in near-all weather conditions to virtually any small airport in non-radar, non-towered airspace

Objectives

Higher-Volume Operations in Non-Radar Airspace at Non-Towered Facilities

Lower Landing Minimums at Minimally-Equipped Landing Facilities

Increase Single-Pilot Crew Safety & Mission Reliability

Enroute Procedures & Systems for Integrated Fleet Operations

Mobility

Enable people to travel faster and farther, anywhere, anytime

Capacity

Performance

Less travel time at an affordable price

Accessibility

Safe reliable access to more locations, when & where you need it

Cost

User cost
System cost
Provider cost

Time

Doorstep to destination, with intermodal penalties

Availability

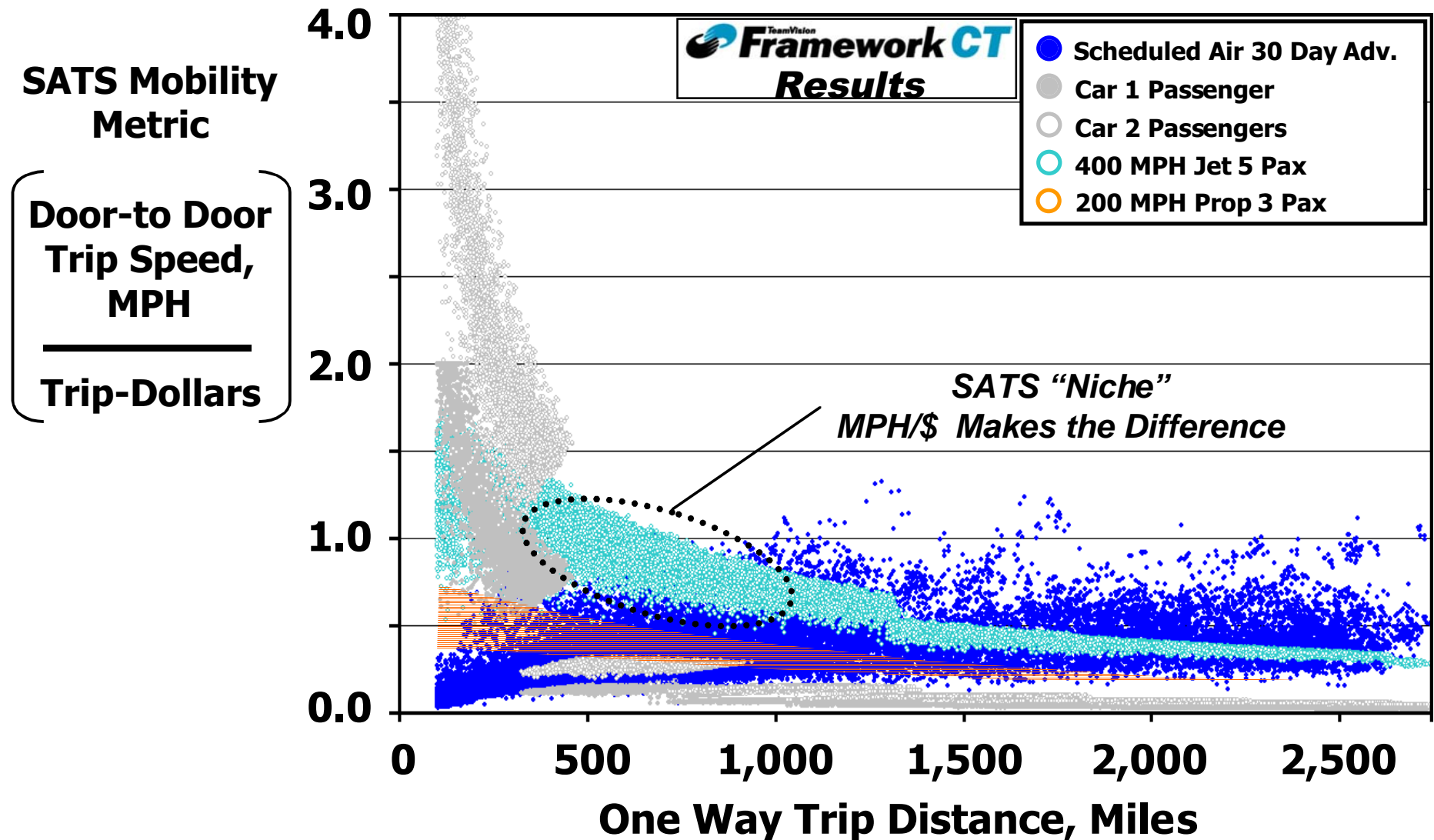
Convenient, on-demand, with mission reliability

Safety

Proven safer
Perceived safer



Filling Gap in National Transportation System





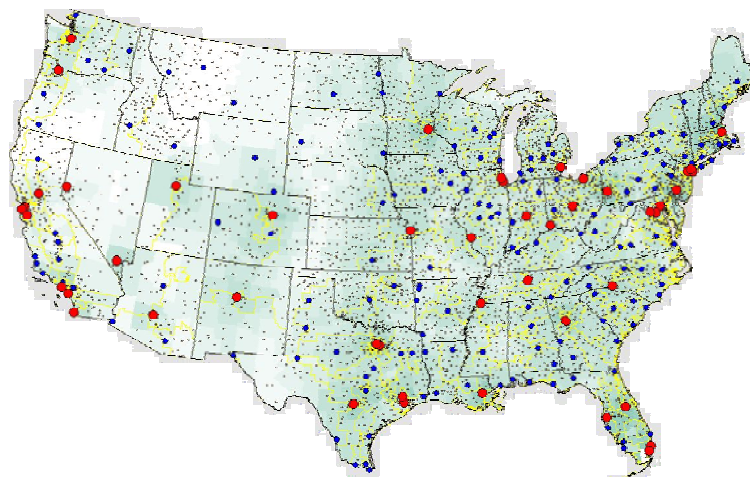
Average Speed Improvement

"Reduce intercity travel time by half in ten years..."

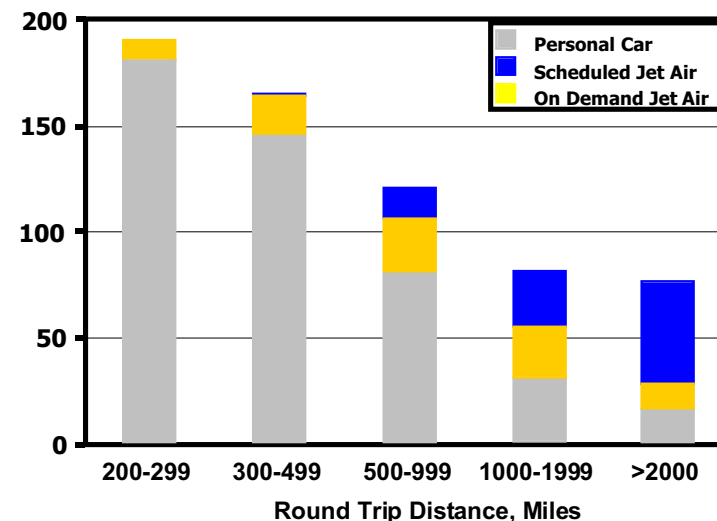
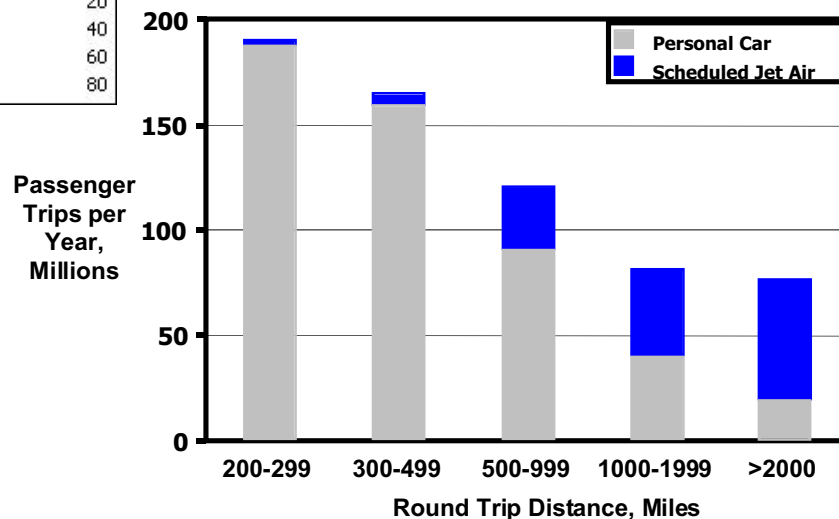
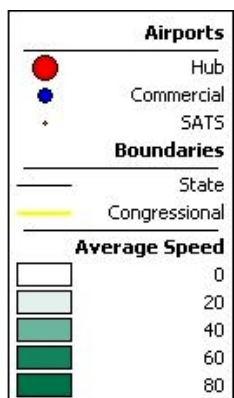
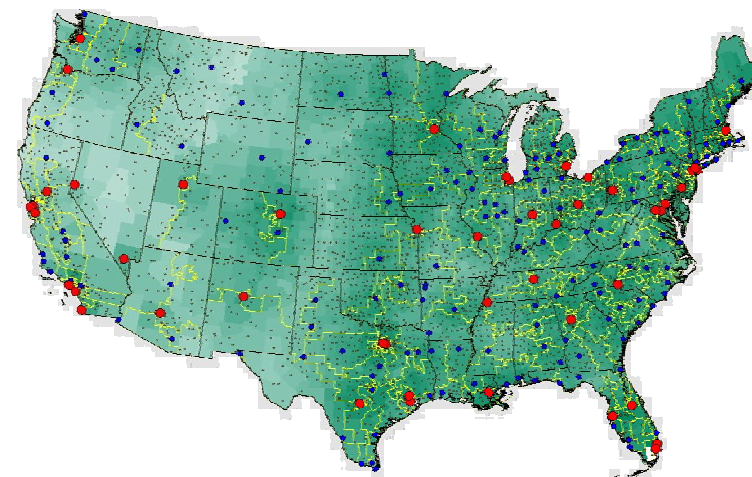


500
to
1,000

Without SATS



With SATS





SATS Program Objective Metrics



- **SATS Questions:**
 - **How many travelers/does it take to “reduce intercity travel time by half... ?”**
 - **How many and which origins and destinations need to be served by SATS to “reduce intercity travel time by half... ?”**
 - **What runway approach minimums and enroute sector capacity must be satisfied to “reduce intercity travel time by half... ?”**
 - **What threshold(s) of cost of SATS travel must be satisfied to “reduce intercity travel time by half... ?”**



Advanced General Aviation Transport Experiments



60 Members
\$200 Billion Sales
9 Universities
9 Avionics Co.
8 Airframe Co.
4 Trade Associations
2 Engine Co.
1 Retrofit Co.

25 States
20 Princ. Members
37 Supp. Members
2 Assoc. Members
3 Gov't Partners
7 Technical
Work Packages
3 Management
Work Packages

AGATE Members





Technical Revitalization is Nearing Completion

(Based on Investments from 1994-2000)



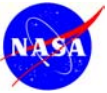
AGATE, GAP, SBIR/STTR, other investments since 1994 have created:

- Aircraft deliveries up 300%
- Billings up 360%
- Fleet safety up 20%
- Exports up
- Jobs up 8% per year
- Industry is “technology-ready”



Revitalized R&T Base for advancements in:

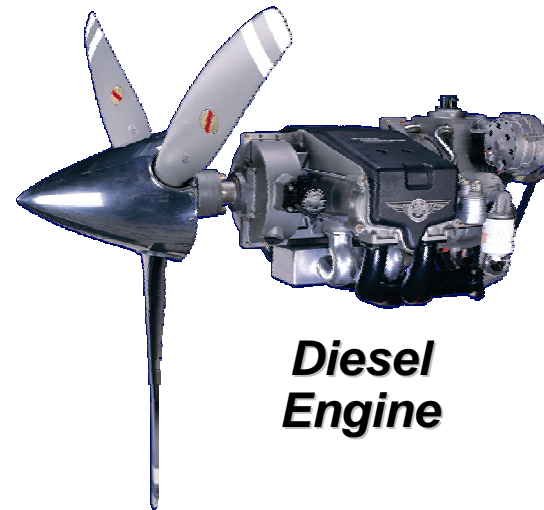
- Primary Flight Displays
- Multi-Function Displays
- Highway in the Sky operating system
- Engine Info & Control Advisory System
- Solid-State Attitude-Heading Ref Syst.
- Databus
- GAP Turbines
- GAP “Diesels”
- Full Authority Digital Electronic Contr.
- Single Lever Power Control
- Quiet Propeller Design & Tools
- Integrated Private/IFR Pilot Certification
- COTS for Cockpits
- Composite certification simplification
- Composite Repair Standards
- Crashworthiness Design Guide
- Lightning Protection Design Guide
- Ice Protection & Avoidance Systems



AGATE / GAP - Vehicle Focused Advancements



- **Vehicle-based**
 - *Design Guidelines*
 - *System Standards*
 - *Certification Methods*
- **New vehicle architecture**
 - *supports application development*
 - *enables new operating capabilities*





Market Pull for Increased Mobility



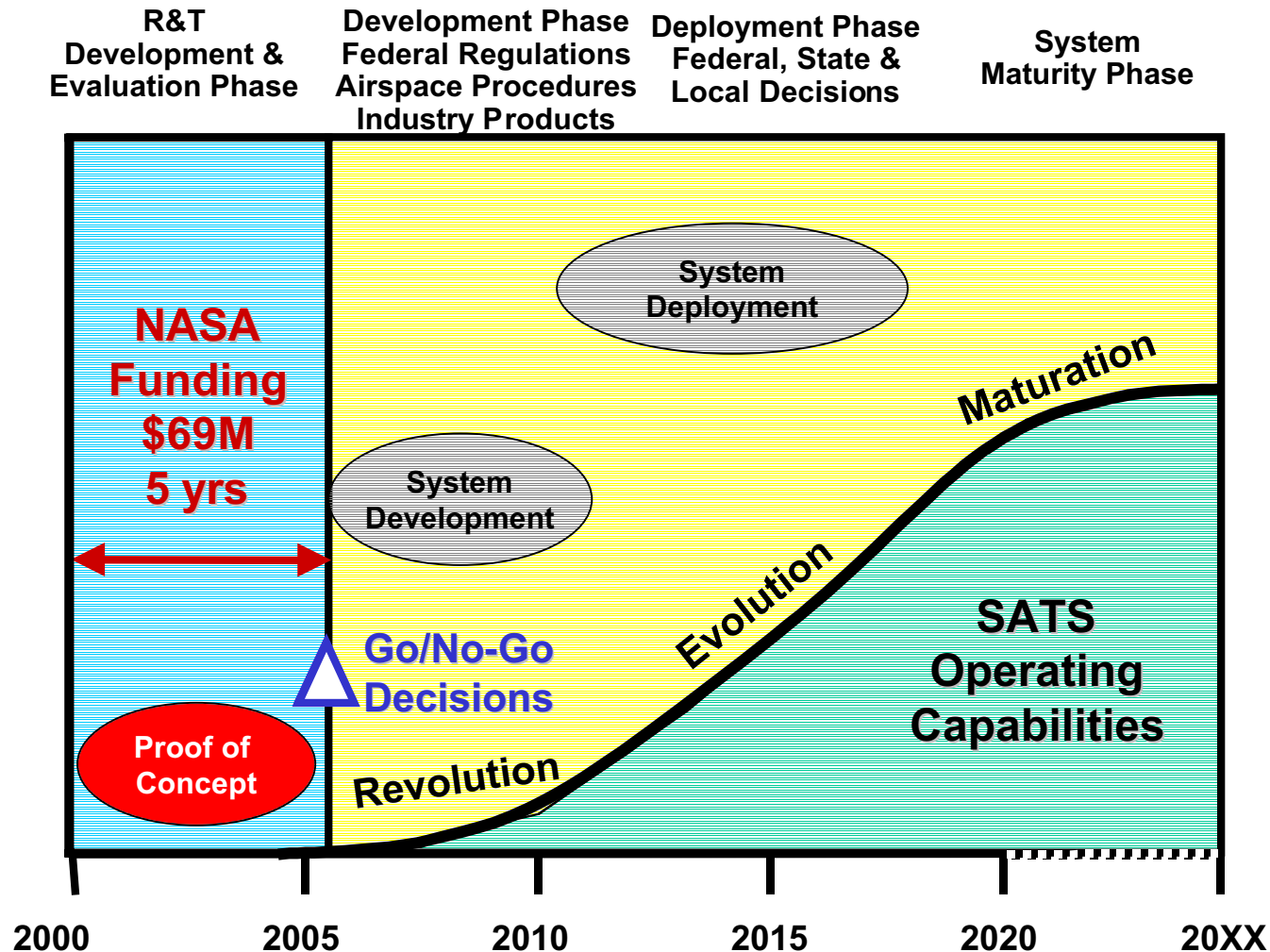
- **Booming Business Jet Market**
 - *Dramatic growth in fractional ownership (50%/year)*
- **New class of microjets**
 - *Low-cost: about \$1.00/aircraft-mile*
 - *Designed to access small airports*
 - *Jet-taxi services emerging in market*



And others....



First Step Is To “Prove SATS Works”



**Technical, Operational, & Socio-economic Basis
for National Investment & Policy Decision**



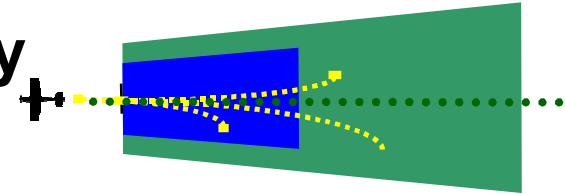
SATS Operating Capabilities



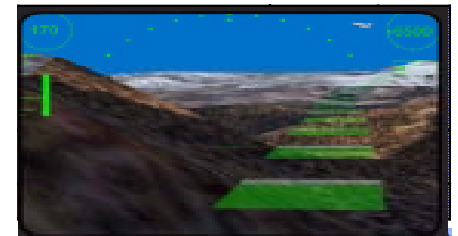
**Higher Volume Operations in Non-Radar
Airspace and at Non-Towered Airports**



**Lower Landing Minimums at Minimally
Equipped Landing Facilities**



**Increase Single-Pilot Crew Safety &
Mission Reliability**



**En Route Procedures & Systems for
Integrated Fleet Operations**





SATS Program Objective

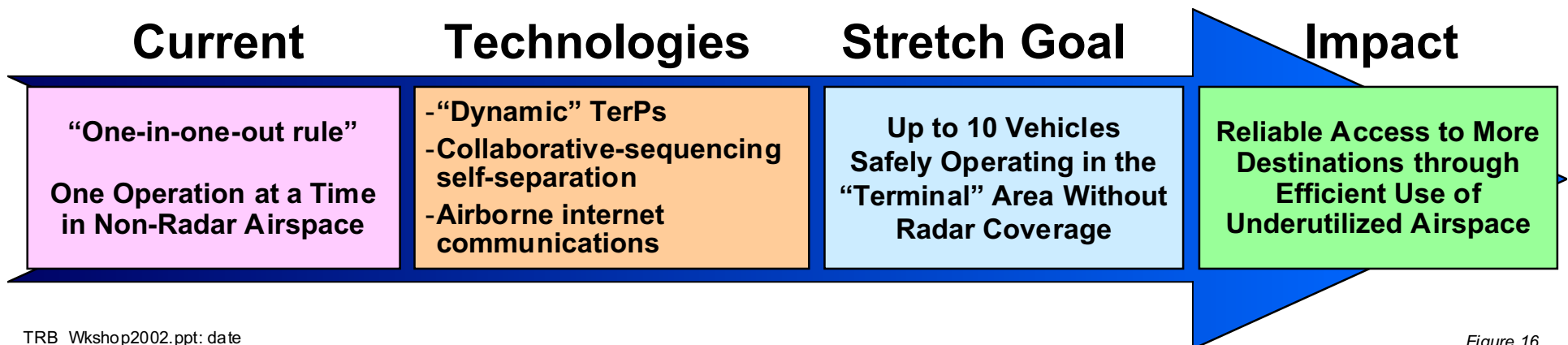
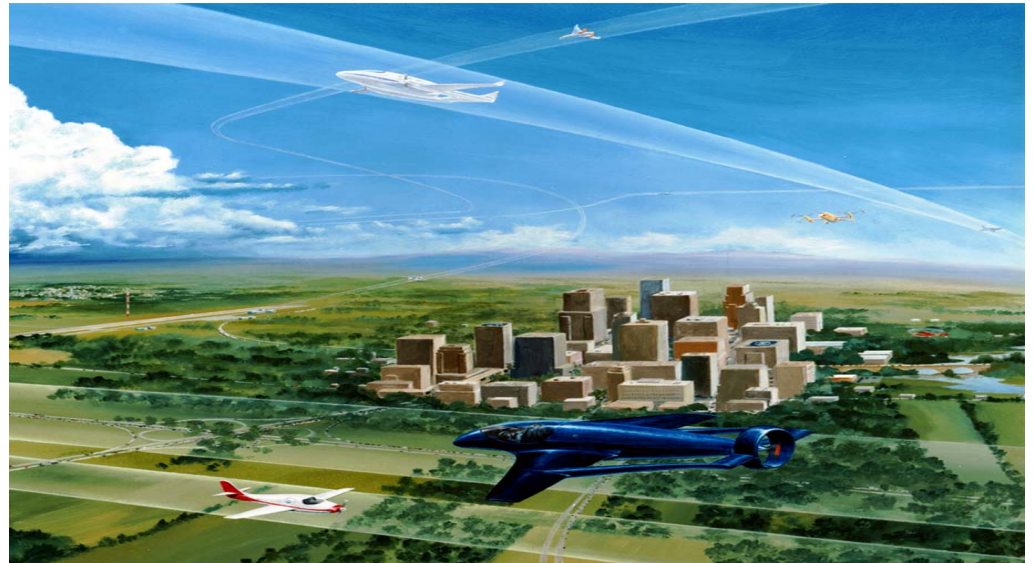


Higher-Volume Operations at Non-Towered/Non-Radar Airports

Demonstrate simultaneous operations by multiple aircraft in non-radar airspace at and around small non-towered airports in near all-weather conditions

Metric

Number of vehicles operating in “terminal area”





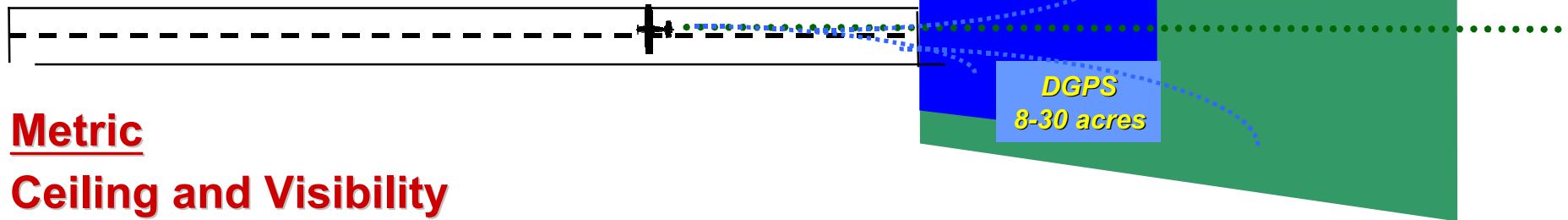
SATS Program Objective



Lower Landing Minimums at Minimally Equipped Landing Facilities

Demonstrate precision guidance,
at any landing facility while
avoiding land acquisition,
approach lighting, and ground-
based instrument landing systems

Runway Protection Zone (RPZ)



Metric

Ceiling and Visibility

Current

Technologies

Stretch Goal

Impact

Ceiling and Visibility
Requirements
as Restrictive as
1000 Ft and 3 Miles

- Synthetic Vision
- 4D Pathway Guidance
- Software Enabled Controls

Ceiling and Visibility
Requirements as Low as
0 Ft and 1/4 Mile

More Landing Facilities
Available More Often At
Less Cost



SATS Program Objective

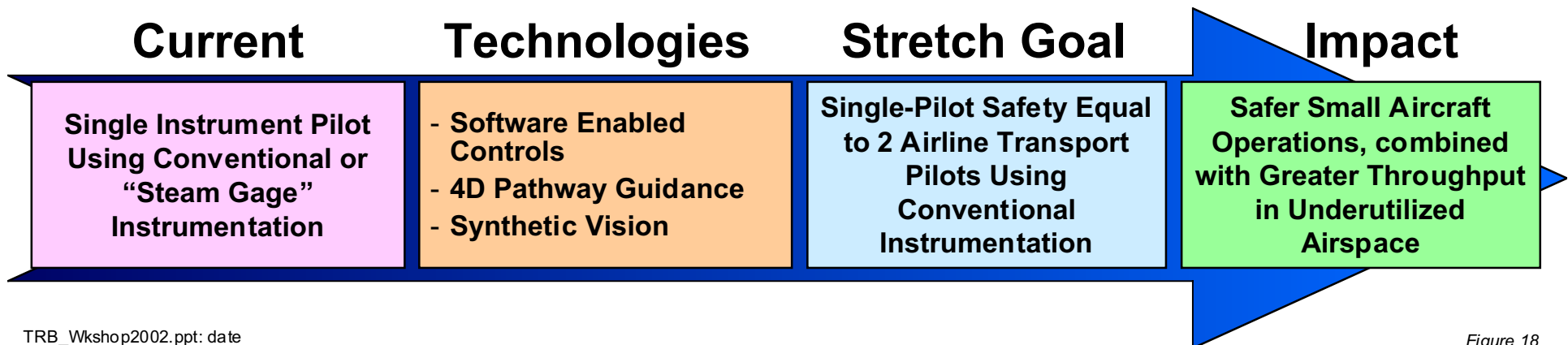


Increased Single-Pilot Crew Safety and Mission Reliability

Demonstrate single-pilot safety, precision, and mission reliability, better than a “professional pilot” using conventional instruments

Metric

Total System Performance





SATS Program Objective

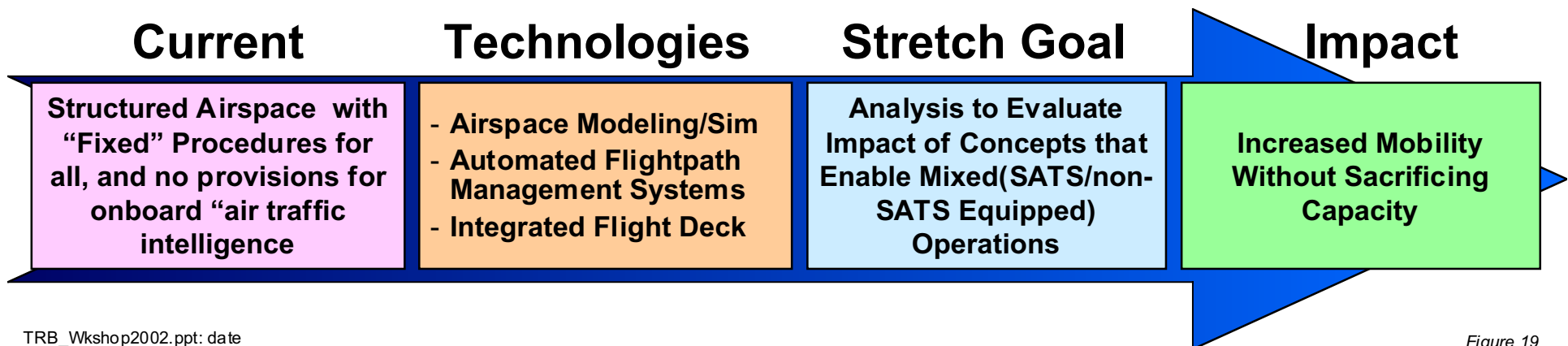
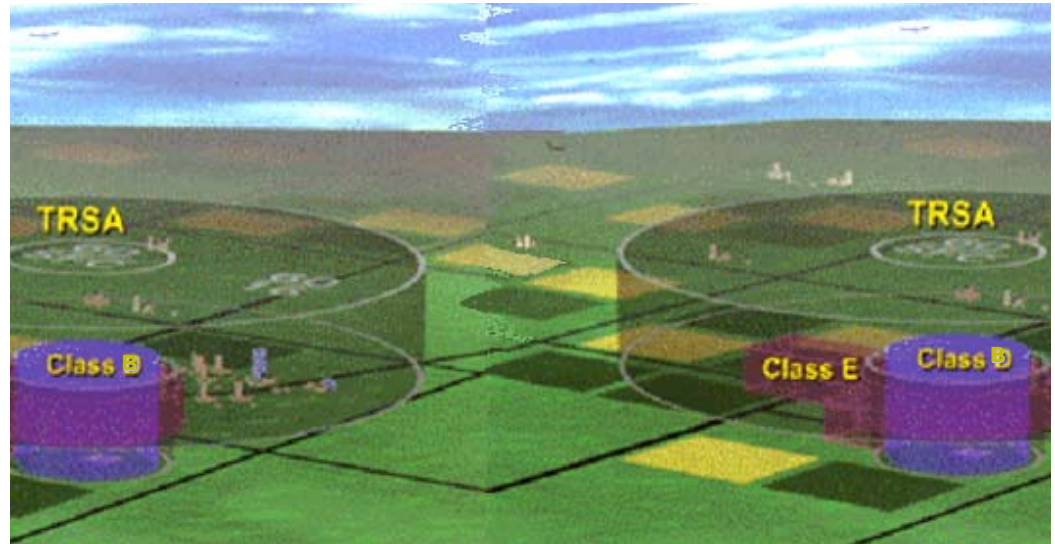


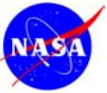
En Route Procedures & Systems for Integrated Fleet Operations

Simulation and analytical assessment of concepts that integrate SATS equipped aircraft into the higher en route air traffic flows and controlled airspace

Metric

**Mobility vs.
NAS Traffic Volumes**

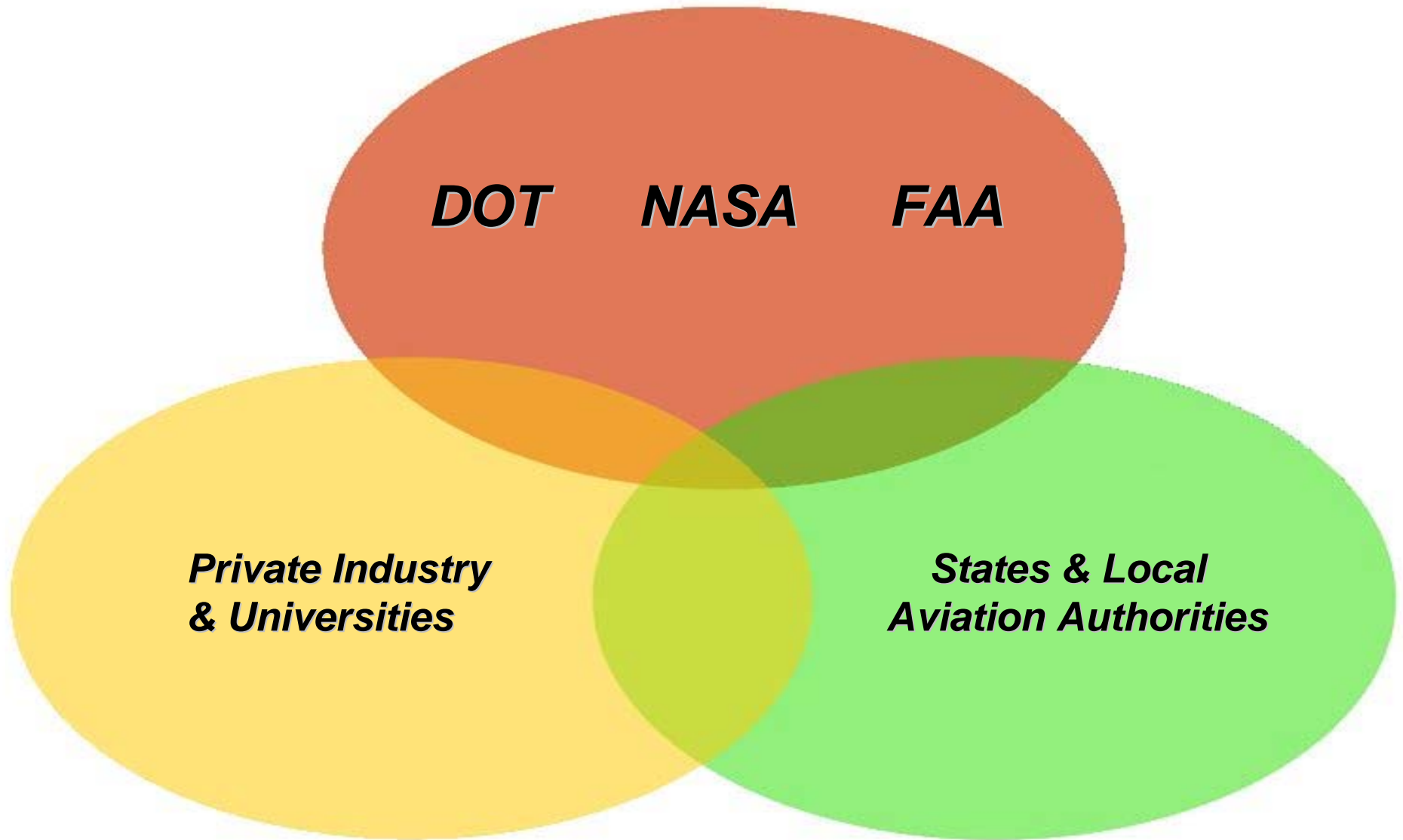




Collaboration

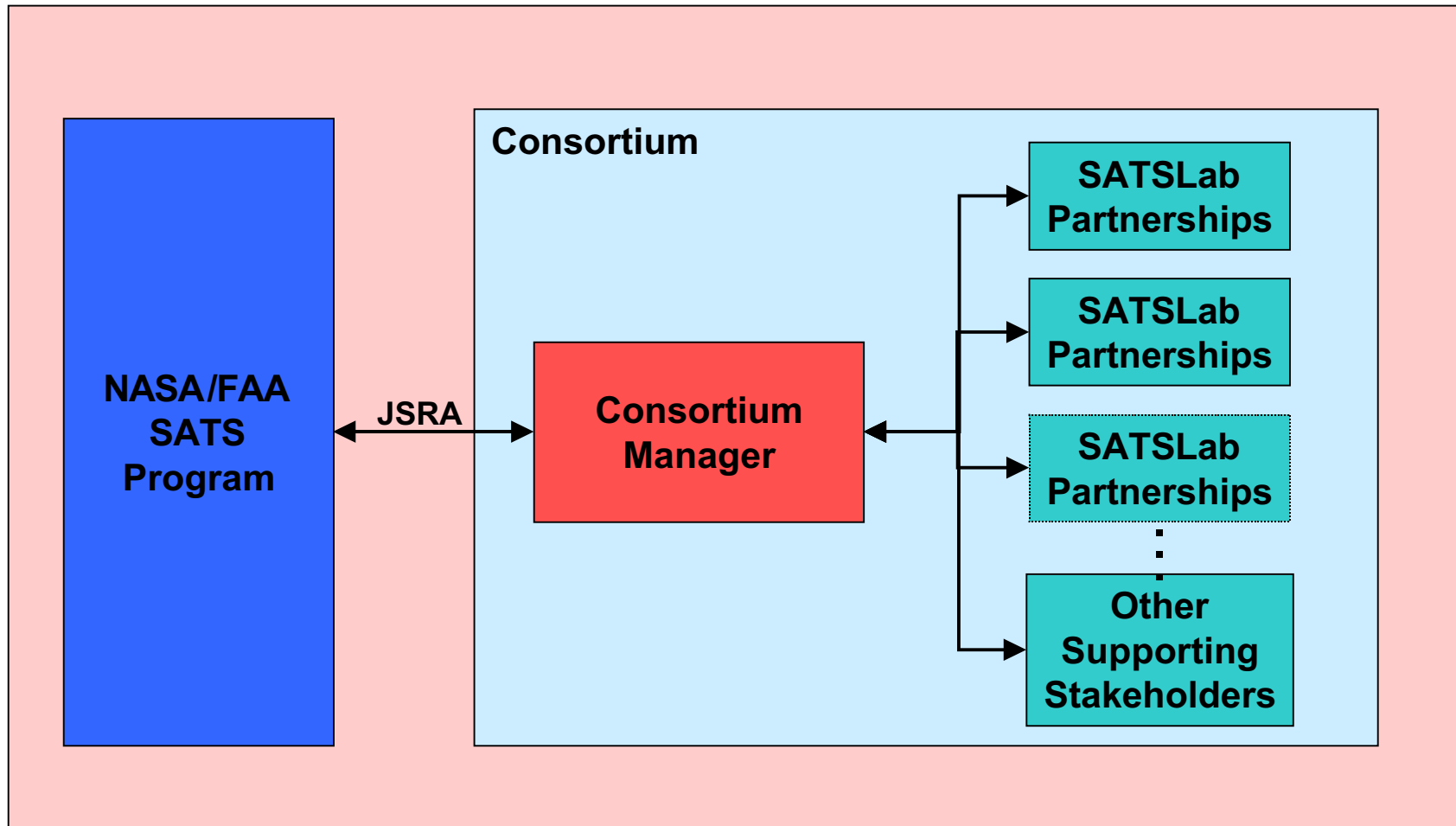
Public-Private

Federal-State-Local





Alliance Relations

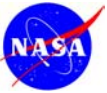




Summary



- ***SATS is a proof of concept R&D program***
 - ***Congressional direction on four operating capabilities***
 - ***Collaborative, cost-sharing public-private alliance***
 - ***Flight experiments and simulations leading to a 2005 demonstration***
- ***State transportation authorities, policy-makers, and opinion leaders play a vital role as the audience and stakeholders in the SATS proof-of-concept demonstration***
 - ***AASHTO***
 - ***NASAO***
 - ***NGA***
 - ***Legislative organizations (ALEC, NCSL, etc.)***
- ***SATS Program objective metrics will focus on:***
 - ***How many trips (people or packages) does it take to double the speed of the nation***
 - ***What technologies and systems enable this doubling to occur and where?***



Breakout Groups

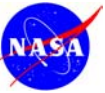
Group & topics

Facilitator

- | | |
|--|---|
| <ul style="list-style-type: none">• Airborne Enabling Technologies:<ul style="list-style-type: none">– Flightpath Guidance– Flight Deck Systems– Communication/Navigation/Surveillance Systems• Transportation System Analysis and Assessment<ul style="list-style-type: none">– Economics– Market demand behavior– Technology performance metrics• Technology Integration and Flight Evaluation<ul style="list-style-type: none">– Flight research aircraft and experiments– Simulation experiments and modeling– Airspace systems– Airspace procedures | <p>Ron Swanda, GAMA</p>

<p>Ron Mauri, Volpe</p>

<p>Dres Zellweger, FAA</p> |
|--|---|



Breakout Groups Charter

- ***The SATS Teams (public and private sectors) are the audience for the workshop summary remarks***
- ***The SATS Teams are seeking perspectives from the transportation research community on the steps required to prove SATS works.***
- ***The following specific questions will guide the breakout groups' dialogue:***
 - ***Is doubling the speed of the nation, enabled through the effects of SATS capabilities on accessibility, a valid management strategy for the SATS Program?***
 - ***Is the single, hired-pilot, mixed-fleet (jets and props) early adopter model an appropriate initial target to guide SATS Program technology strategies, system assessment, and demonstration?***
 - ***Who should comprise the audience for the SATS 2005 Demonstration? What information will those audiences require? For what purposes?***
 - ***What else is required to prove SATS works?***



Breakout Groups Rules of Engagement

- ***The Facilitators will guide the dialogue toward the subjects of the questions (the breakout discussions are not intended to focus on re-visiting historical information about SATS).***
- ***The SATS Project Managers' roles in the breakout groups are to serve as scribes, to provide clarifying information, and to provide report-out summaries.***
- ***The Breakout Groups should focus predominantly on the following specific questions:***
 - ***Airborne Enabling Technologies: Ron Swanda, GAMA***
 - ***Is the single, hired-pilot, mixed-fleet (jets and props) early adopter model an appropriate initial target to guide SATS Program technology strategies, system assessment, and demonstration?***
 - ***What else is required to prove SATS works?***
 - ***Transportation System Analysis and Assessment: Ron Mauri, Volpe***
 - ***Is doubling the speed of the nation , enabled through the effects of SATS capabilities on accessibility, a valid management strategy for the SATS Program?***
 - ***What else is required to prove SATS works?***
 - ***Technology Integration and Flight Evaluation: Dres Zellweger, FAA***
 - ***Who should comprise the audience for the SATS 2005 Demonstration? What information will those audiences require? For what purposes?***
 - ***What else is required to prove SATS works?***